Testing the SVX-II Chips at the Brookhaven Test Beam
June 4 through June15, 1995

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June 4 We arrived at BNL early Sunday afternoon and immediately began setting up the electronics. See Figure 1. We soon realized that the Tektronix 644A oscilloscope was a casualty of a rather bumpy ride we experienced in the hour or so prior to sustaining a tire blow-out on the Indiana toll road. The scope was still useful, however, but the signal was quite noisy at timebases faster that 10us per division.

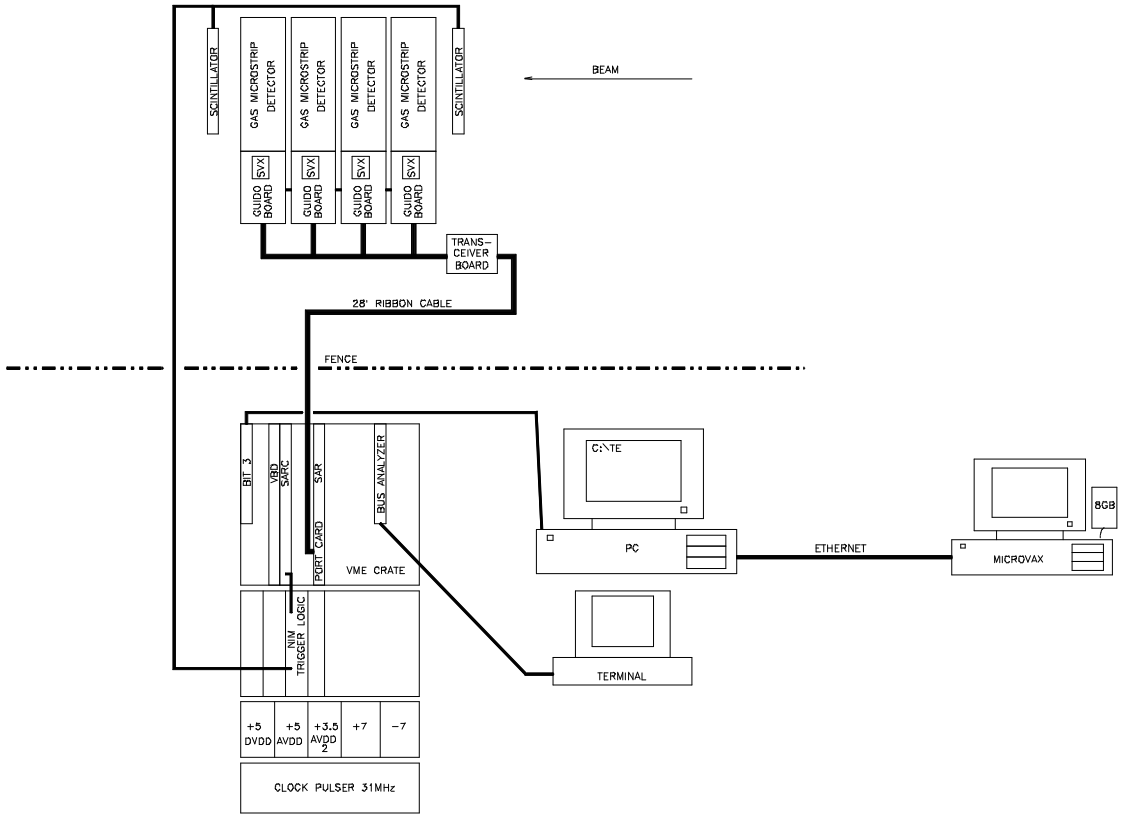

Figure 1. Test beam configuration at BNL

Two improper power-off sequences happened early-on in the setup; first when the DVDD supply tripped while the crobar setting was being adjusted, and second when the rack power cord was unintentionally unplugged. No apparent damage to the chips was realized.

By the end of the first day we had four SVX-II boards each connected to gas microstrip chambers and the Calibration-inject function was sucessfully working.

June 5 The morning was devoted to setting up the trigger logic. We then began to look at the data for any obvious signs of a track. On thing to note is that we had to slow down our master clock to the SVX from 53 MHz to 31 MHz. Although I had one SVX-IIB chip running successfully at 53MHz at the end of our 28 foot cable, things ceased to function when I connected four chips at the end of the long cable. The slower clock got things working again.

Various settings of pipeline depth were used in an attempt to find tracks. No signs of any tracks were evident with pipeline depths ranging up to a value of six, which should account for trigger and electronics delay of 1.3us. A timing diagram based on measured delays through the electronics indicated the pipeline should be set to four or five. By the end of the night Guido found that the high voltage had been turned down during the time we were attempting to find tracks.

June 6 AGS studies were scheduled, but an extraction septum failure took the machine down anyway. While beam was down one of Guido's colleagues from Stony Brook hooked up an Ethernet connection so we could send data directly to a microvax.

We then took pedestal data. After this was complete we set up the calibration to simulate actual tracks so that Guido could test his software for looking at tracks.

By the afternoon the AGS administrators had decided to extend the run by one week.

Beam was back up later that evening and we thought we might be seeing some tracks on a program Guido had written that gave a crude version of a histogram. A full-scale hit of 255 counts would show up as a vertical column of six characters. It was getting late and we elected to leave the power on , get some rest, and take lots of data in the morning.

June 7 Wednesday began with problems downloading to the four chips. We noticed that the DVDD power supply was current-limiting and the output was only at 4 volts.

It had been a hot and humid night so we figured the chips might have been too hot, especially since they were encased in a protective plastic box glued to the circuit board, effectively creating an oven.

We turned off the supplies and fashioned a plastic tent and boiled cold Nitrogen gas into the tent to dry and cool the electronics. The chips promptly caused the supplies to current-limit anyway. We began to remove chips from the readout chain and after a few such iterations found two boards that ran without drawing excessive current. Throughout all this activity we were straining to see if tracks were appearing in the data. We tried different preamp bandwidth settings and different settings of ramp pedestal and reference.

June 8 After reconstructing a timing diagram to try to get a better feel for what the pipeline depth setting should be, it was decided to use a pulser connected to a copper strip which in turn would capacitively couple to the traces leading to the inputs of the SVX-IIB chip. This pulsed signal was then run into a tee very near the chambers and run back one of the scintillator cables. Such a configuration allows us to vary the pipeline until we see the channels being pulsed, thereby determining the correct pipeline setting. Only one 50ns allowance must be made for the PMT delay. In this case the pipeline value was determined to be six and we centered the likelihood of events in our acquisition window with a 130ns delay added to the trigger.

After the pipeline was correctly set it was still difficult to claim tracks with the software that was available. The fact that there were only two SVX-II chips that would run without drawing excessive current precluded any convincing evidence.

June 9 The decision was made to adjourn our test beam session, get the three worst chips replaced at Fermilab, and return Tuesday to take advantage of the three remaining days of beam.

June 12 At Fermilab Microscope views of the three SVX-II chips revealed obvious blemishes on the traces connecting the input pads to the protection diodes. Ray Yarema pointed out that the blemishes were not necessarily related to the large current draw.
A group of people worked through the weekend and on Monday to put new chips on our interface boards.

June 13 At Brookhaven The first several hours were spent verifying that the two old chips still at least responded to the Calibration pulse, as well as the three new chips. During this time pedestal data was taken for one board before and after adding external protection diodes. No significant change in noise was noted so diodes were added to all boards. We then determined dead channels and perpetually-saturated channels for all five chips. Four chamber assemblies were then put into the beam and the data taking began.
Tracks were not especially evident until the high voltage was increased to 760 volts. We then took data until 4am, but beam was very erratic as the AGS was having problems.

June 14 Beam was off due to an AGS vacuum problem during the day. During this time the software was modified to speed up data taking by not converting the data from gray format before sending to the microvax. Event rate to disk increased from one trigger per spill to six to eight triggers per spill. The AGS had a cycle time of 3.7 sec.
About 10am an explosion occurred in the hall. It turns out what really happened was an implosion of a mylar/kevlar window in a vacuum chamber measuring 2ft.x 4ft. x 15ft. in a nearby beamline. The fate of our beam was uncertain at this point but it was eventually permitted. By 1600 hours beam had returned.
In the evening we rearranged the chambers and interface boards so that the three most efficient chambers were paired with the three best chips. Data runs were then taken throughout the night. Perhaps 50,000 events were recorded.
One problem revealed during this period was that occasionally two consecutive events on disk were absolutely identical. It is still not known whether this problem originates in the SVX-IIB or elsewhere. We are currently trying to determine a method of troubleshooting this problem.

June 15 At approximately 0530 we were informed that the slow-extracted beam would be discontinued sometime in the morning. We had expected to run until 6am Friday. Also about this time we began having problems renaming the data files on the microvax. The run was over and the availability of our data on the disk was uncertain.

June 23 The present status of the disk is that about 40% of the files are recovered. Guido is having some success and it is expected that most of the data may be recovered in the next few days.

The following set of histograms is typical of a track reconstructed from the test beam data.

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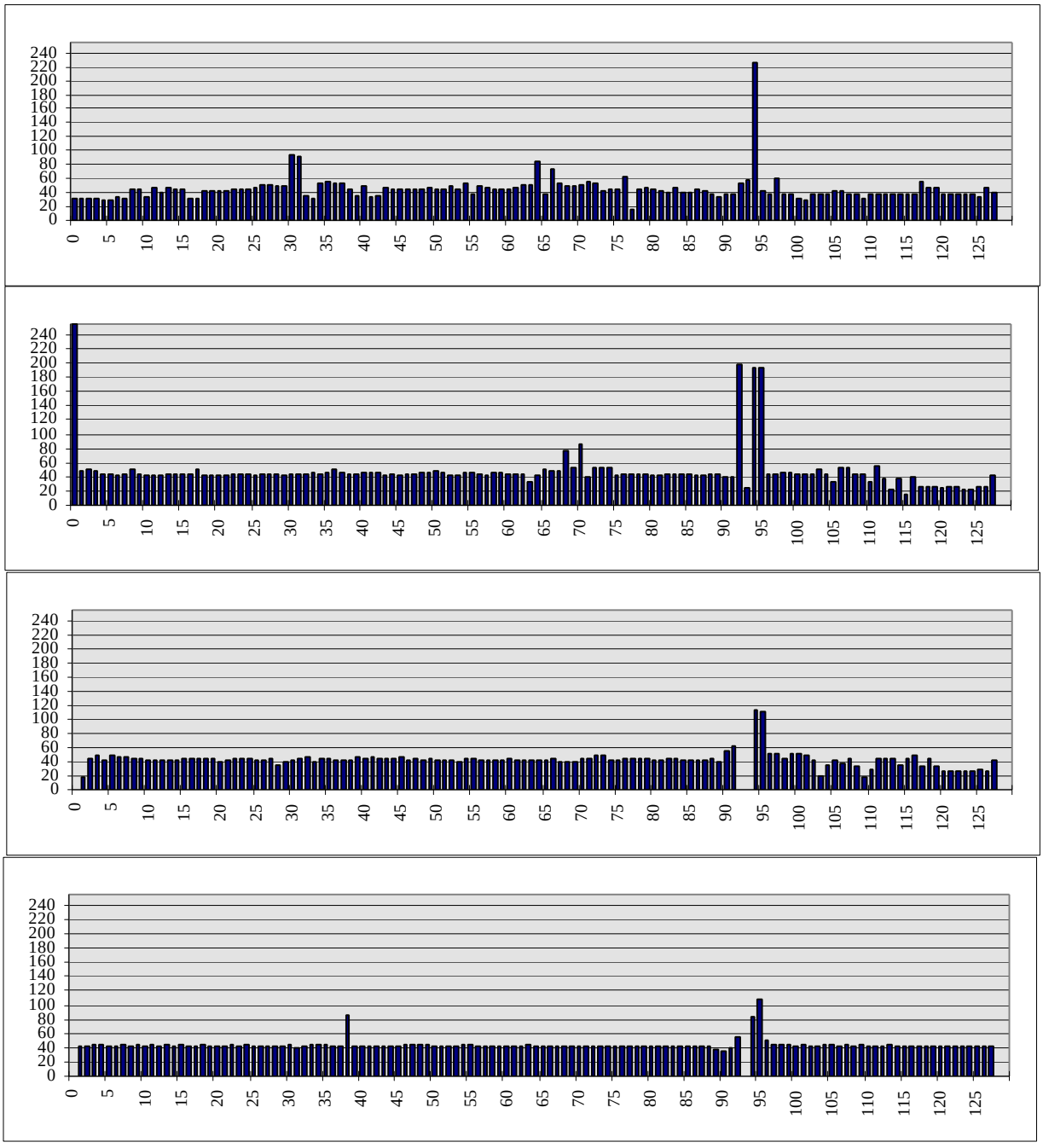

Figure 2. A track as seen by four Gas Microstrip detectors connected to SVX-IIB chips using prototype electronics for the D0 Upgrade's Silicon Strip Detector.